NASA SBIR/STTR Technologies

Proposal No. 07-2 S2.05-9744

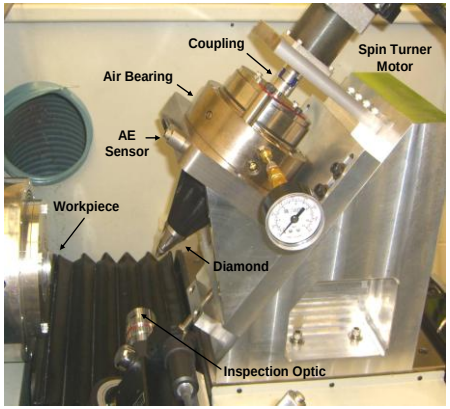
The Affordable Pre-Finishing of Silicon Carbide for Optical Applications

PI: Jay C. Rozzi, PhD

Creare Inc., Hanover, NH 03755

Identification and Significance of Innovation

Large aperture, lightweight, optical mirror technologies are critical for the future of lightweight telescopes to explore our solar system and beyond. Cost-effective manufacturing techniques for pre-finishing silicon and silicon carbide (viable alternatives for lightweight mirrors) have not been sufficiently developed. Our hybrid machining process has the potential to substantially reduce the cost of producing these optics and enable the increased functionality of new and existing platforms. The results of our work would have far-reaching benefits for government aircraft and military systems. TRL: 6



Technical Objectives and Work Plan

The overall objective was to develop an affordable pre-finishing machining process for use on super-hard materials for optical applications. Our approach was to use a hybrid machining process based on a single-crystal spin-turner that we integrated onto a precision diamond turning machine. Using our hybrid process, we machined silicon and silicon carbide trial parts to optimize the cutting conditions, evaluate the machined part quality and tool wear characteristics, and produce a silicon demonstration article for NASA review.

NASA Applications: Lightweight telescope optics for space exploration.

Non-NASA Applications: Cost-effectively manufacturing super-hard materials like silicon and silicon carbide has always been the primary barrier to commercial acceptance of this advanced material technology. For many applications, such materials offer significant advantages over other options, but their cost precludes their consideration in design. Effective and affordable manufacturing processes are required to render these materials as a viable design option in such markets as commercial aircraft, automobiles, cutting tools, artificial joints, and various other applications.

Firm Contacts

Dr. Jay Rozzi
Creare Inc.
P.O. Box 71
Hanover, NH, 03755
Phone 603-643-3800
jcr@creare.com